quantities of the D_2O may be increased. A typical example utilizing the method according to the present invention is as follows:

Within the range of between about 20° and 200° C. and at pressures of about one atmosphere to about 200 atmospheres, up to 33 ⅓ atom percent ≅ 1 percent by weight of hydrogen are incorporated as TiNiH in the TiNi alloy. In contrast thereto under the same condition no dissolution of deuterium takes place in the TiNi-lattice, as can be readily proved. Hydrogen consists to about 99.9855% of the isotope $_1{}^1H$ and to about 0.0145% of the isotope $_1{}^2D$. Consequently, 0.145 mol of deuterium correspond to 1,000 mol of hydrogen each. If one causes the content of a 100 liter pressure container with a filling pressure of 224 atmospheres (1,000 mol hydrogen) to react with the TiNi alloy at temperatures at which the dissociation pressure of the hydrogen amounts to at most 2 atmospheres, then 1,000 mol hydrogen are dissolved in 200 kg TiNi (50 l volume) within the temperature range between about 20° C. and about 250° C. If now the pressure container is now disconnected at an interior pressure of one atmosphere, then only about 5 mol hydrogen remain in the container whereas 0.145 mol deuterium remain in the same since this was not absorbed in the TiNi-lattice. If this residual gas is compressed to a volume of 500 cm^3 (approximately **220** atmospheres) and is brought into contact under the conditions indicated hereinabove with 1.5 kg TiNi, then the residual gas resulting therefrom consists at about 5 atmospheres of 0.02 mol hydrogen and 0.145 mol deuterium.

The speed of separation depends only on the cooling speed of the TiNi alloy (reaction enthalpy smaller than 10 k cal/mol H_2), it amounts with the aforementioned dimensions and with a sufficient water cooling to about 15 to 30 minutes.

Consequently, in only two stages the ratio H:D of 7000:1 can be changed into 1:7, i.e., by about a factor of 50,000. A greater enrichment or concentration can be realized either by way of further hydride stages or with the aid of other known methods (Clusius separating column). In that connection the thermal separating effect can possibly be further assisted by the absorption of the hydrogen in the TiNi alloy. Consequently, depending on the desired efficiency, any required quantitiy of the TiNi alloy can be brought into the respectively desired temperature zone in the Clusius column.

The powder particle sizes is not uniform and may be selected between about 10μ and about 1 mm.

The mixtures may be between 0–100% and 100–0% of Ti_2Ni and TiNi.

The dehydrogenation takes place at pressures of about 0.1 atmosphere beginning with temperatures of about 100° C. and with greater velocity beginning with temperatures of about 200° – 250° C.

Up to about 10% by weight of zirconium may be used instead of titanium for reducing the binding enthalpy of the hydrogen.

Up to about 25% by weight of copper may be used instead of nickel to produce a better mechanical stability of the individual granules. Nonetheless, the porosity and form of the sintered bodies remain preserved.

In the drawing the single FIGURE schematically illustrates an installation which may be used for carrying out the present invention.

Reference numeral **10** thereby generally designates a conventional pressure vessel or container having a piston or plunger **11** which is adapted to be actuated by conventional means. Hydrogen is fed into the vessel **10** at 224 atmospheres through inlet line **12** by way of control valve **13.** The pressure container **10** is connected, on the one hand, by way of a line **14** containing a control valve **15** with a second container or vessel **16** which contains TiNi powder, for example, 200 kg (50 l) of the alloy. The vessel **16** is appropriately heated or cooled by the use of conventional means, such as an appropriate conventional heating and cooling system generally designated by reference numeral **17** and therefore only schematically indicated. The discharge or removal from the container **16** takes place by way of a line **18** including a control valve **19.**

The pressure container **10** is further connected with a small vessel or container **20** by way of a line **21** containing a control valve **22.** The container **20** is again adapted to be heated and cooled by conventional means only schematically indicated and designated generally by reference numeral **23.** For example, about 1.5 kg of the TiNi powder is provided in the container **20.** The outlet from the container **20** takes place by way of line **24** including the control valve **25.**

A further line **26** including a control valve **27** is provided to permit the removal of D_2 and H_2 for further enrichment of concentration.

In the position **1** of the piston **11**, valves **15, 19, 22** and **27** are closed while valve **13** is opened. The pressure in the 100 liter vessel or container **10** is 224 atmospheres. The valve **13** is then closed and valve **15** is opened. The hydrogen then reacts with the TiNi alloy in the container **16.** The pressure in the container **10** is now permitted to become about **1** atmosphere and valve **15** is closed.

The piston **11** is now moved to its position **2** indicated in dash lines whereupon the valve **19** is opened, the heating system **17** is controlled to increase the temperature by about 100° C. thereby causing a discharge of hydrogen out of the TiNi container **16.**

The pressure underneath the piston **11** is about 200 atmospheres. Valve **22** is now opened and the hydrogen reacts with the TiNi powder in the container **20.** The pressure under the piston **11** is thereby permitted to become about 5 atmospheres. Valve **22** is now closed and valve **25** is opened while the heating system **23** is controlled to provide an increase of about 100° C. causing a discharge of H_2. Thereupon the heating system **17** is controlled to reduce the temperature by about 100° C., valve **27** is opened until the pressure under the piston reaches about 10^{-2} Torr. Valve **27** and valve **25** are then closed and the heating system **23** is controlled to reduce the heat by about 100° C.

While I have shown and described only one embodiment in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to those skilled in the art and I, therefore, do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

What I claim is:

1. A method for separating deuterium and hydrogen, comprising the steps of bringing into contact a gaseous mixture of deuterium and hydrogen with a metal alloy material consisting essentially of TiNi, Ti_2Ni, or a mixture thereof, and thereafter separating a non-absorbed residual gas enriched in deuterium from the metal alloy material after a period of time sufficient for the absorp-